PROJECT REPORT COMMITTEE ON FOOD RESEARCH QUARTERMASTER FOOD AND CONTAINER INSTITUTE FOR THE ARMED FORCES CHICAGO ILLINOIS	RESEARCH AND DEVELOPMENT BRANCH MILITARY PLANNING DIVISION OFFICE OF THE QUARTERMASTER GENERAL

COOPERATING INSTITUTION Yale University	LOCALITY New Haven, Conn.	
DIVISION School of Medicine	DEPARTMENT Laboratory of Physiology	
OFFICIAL INVESTIGATOR John R. Brobeck	COLLABORATORS	
REPORT NO. 7	FILE NO. P-1007	CONTRACT NO. W11-009-qm-70195
FOR PERIOD COVERING June 1 - Sept. 30, 1947	INITIATION DATE October 1, 1946	

TITLE: [ ] PROGRESS REPORT [X] PHASE REPORT [ ] ANNUAL REPORT [ ] TERMINATION REPORT

"Effect of food and environment on food intake"

SUMMARY

In two previous reports (nos. 2 and 3), submitted to the Committee on Food Research of the Quartermaster Food and Container Institute, the reactions of rats upon exposure for 18 hours to temperatures ranging from 35° to 95° F. have been described. Now these reactions have been studied more precisely, and food intake, changes in body weight and body temperature, and water intake have all been measured over the temperature range of 65° to 97° F. Results have been summarized on four graphs, figs. 1-4.

RESTRICTED

Continued

Purpose: To investigate in rats the possibility that food intake is a mechanism of temperature regulation.

Procedure: Adult male rats of the Sprague-Dawley strain were acclimatized to a temperature of 82-84° F., and then exposed for 18 hours in groups of 5-6 to a constant temperature somewhere within the range of 65° to 97° F. Food and water intakes were measured, and body temperature and body weight were recorded at the beginning and end of each 18-hour experiment.

Food and water were always given ad libitum; the food used both during the acclimatization and the experimental periods was dry calf meal (G. L. F.)

Results: Food intake slowly fell as temperature increased from 65° to 90° F., then fell more rapidly until at 97° F. the rats ate little or not at all. There was a sharp break in the curve (see fig. 1) between 90° and 94° F.

Most of the rats showed a rise in body temperature following an 18-hour exposure to temperatures of 72° F. or less; this rise seemed to be a consequence of increased motor activity. At 76°-90° F., body temperature fell during the experiments, presumably because the animals were usually quiet or sleeping when the final measurements were begun. At 94° F., body temperature rose by the same amount as at 65°, but for a different reason, namely, the rat's inability to dissipate heat rapidly enough to prevent mild fever. (It will be recalled that at 94° F. the food intake fell sharply.) At 97° F., average body temperature changes were gains of from 2 to 3 degrees F. (fig. 2).

Between temperatures of 65° and 86° F., most rats gained about 5 grams overnight; at 90° F. no gain occurred; at 94° F. a loss of 20 gm. was noted, while at 97° F. the losses amounted to 30 gm. or more (fig. 3).

Water intake was reasonably constant between 65° and 90° F., but rose sharply in the 94° and 97° experiments (fig. 4).

Significance: These data demonstrate the precision with which rats regulate their energy exchange, and suggest that it is possible either to measure or to control most if not all of the variable factors involved in this exchange.

They also suggest that body weight is a more important factor in determining the food intake at certain temperatures than at others. Its importance seems to be greatest in the range to which the animals have been acclimatized (fig. 1).

Comparison of data obtained at 65° and at 94° F. further suggests that food intake may be an important mechanism of

temperature regulation. At both of these temperatures the rats exhibited mild hyperthermia after 18 hours. At 65°, this hyperthermia was evoked by the cold stress and was accompanied by a high food intake; at 94° the fever was a token of the animal's inability to lose heat easily, and was associated with a very low food intake. Food intake is not determined by the absolute body temperature, therefore, but by the conditions of temperature regulation existing at any given time. Because of its heat of utilization (specific dynamic action or S.D.A.), food is in itself a mild heat stress, and the ability of the organism to use this extra heat seems to a certain extent to determine the food intake.

Publications:

Brobeck, John R. Food intake as a mechanism of temperature regulation in rats. (In preparation.)

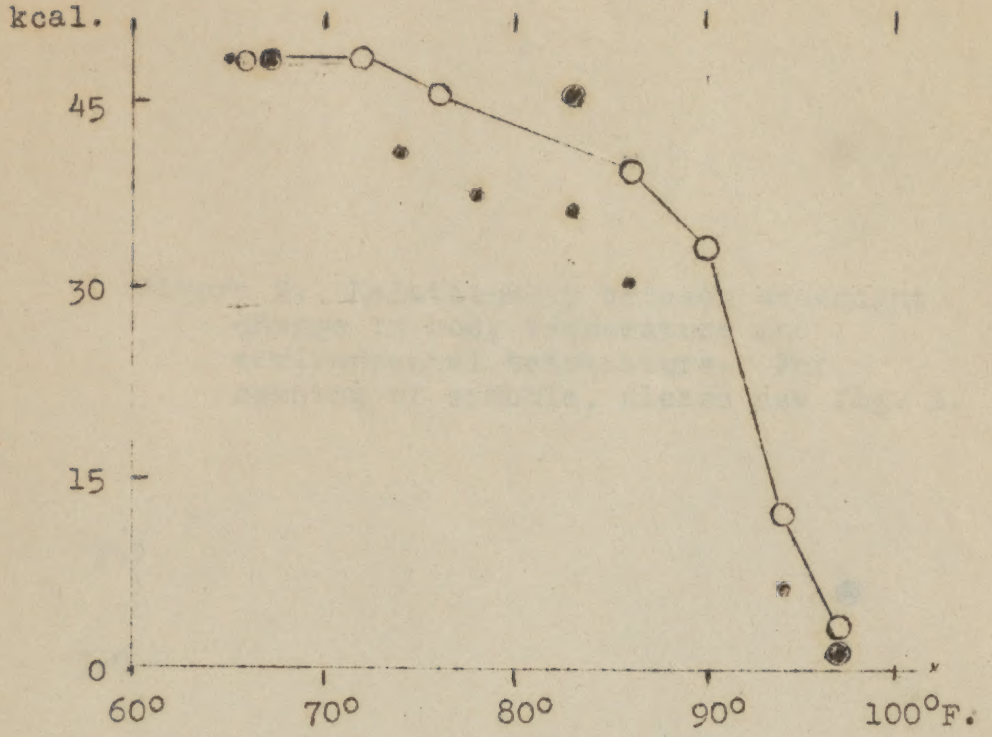

Figure 1. Relation between food intake and environmental temperature. Each point represents a group of 5 - 6 rats. The three symbols on this and the other graphs identify rats according to body weight, as follows:

• - - Body weight averaging 236 - 267 gm.

○ - - Body weight averaging 284 - 307 gm.

● - - Body weight averaging 315 - 330 gm.

Figure 2. Relationship between overnight
change in body temperature and
environmental temperature. For
meaning of symbols, please see fig. 1.

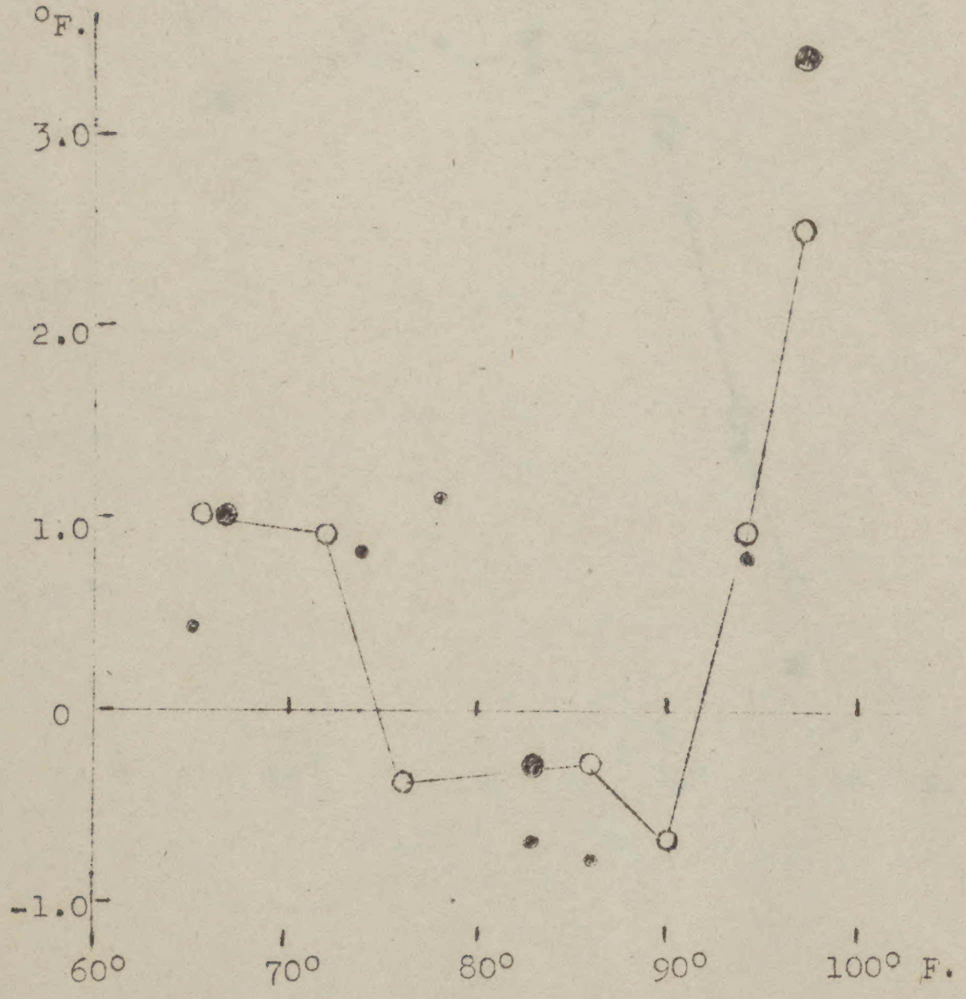

Figure 3. Relationship between overnight change in body weight and environmental temperature. For meaning of symbols, please see fig. 1.

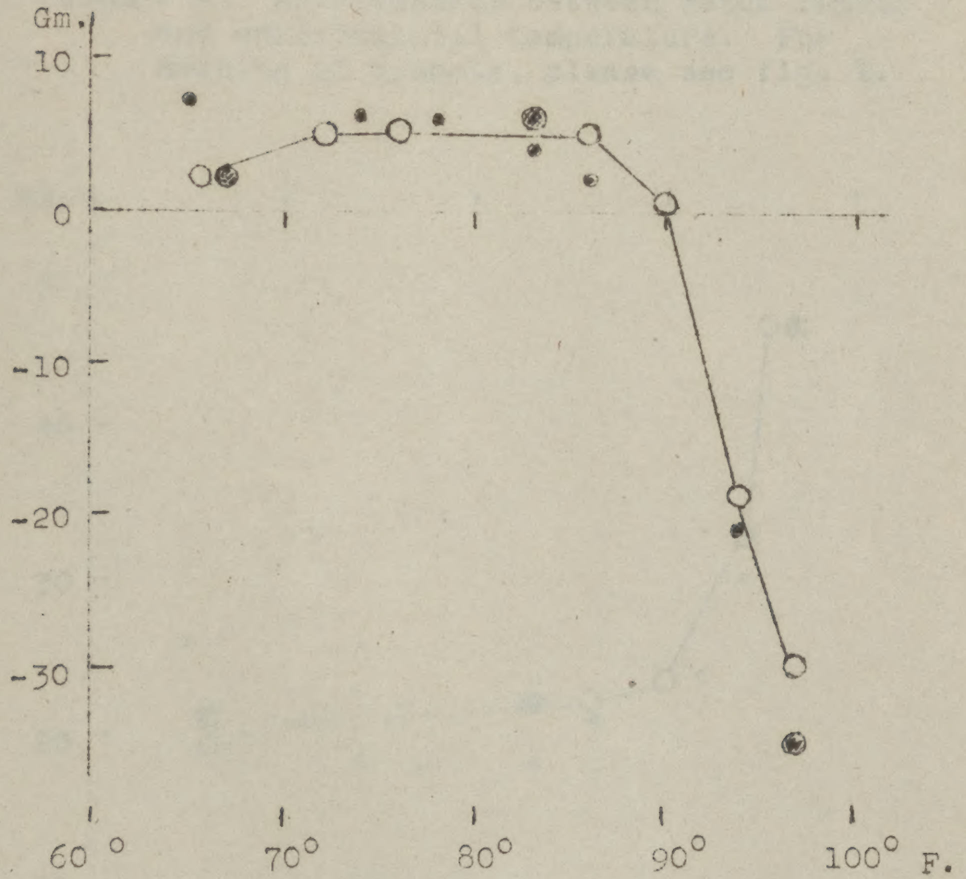

Figure 4. Relationship between water intake and environmental temperature. For meaning of symbols, please see fig. 1.